

## METHANOLIC EXTRACTS OF MEDICINAL HERBS AS A POTENTIAL SOURCE FOR DEVELOPING MOSQUITO REPELLENT FABRICS

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### ABSTRACT

One of the major life threatening deadly diseases are caused by mosquitoes. Apart from the nuisance, the mosquitoes cause severe health problems to human beings. *Aedes aegypti* mosquito carries the major deadly diseases like chikungunya, dengue, yellow fever etc. These mosquito borne diseases can be highly witnessed in all over the world. According to World Health Organization (WHO) there are more than 700000 deaths every year caused by these mosquitoes. Commercially available synthetic mosquito repellents can cause toxic to skin and lungs of human, and it is toxic when it is left on earth. Mosquito repellent from naturally available sources are abundant on

earth. Health care fabrics have gained a massive attention in today's market because of its need among public life and safety. Hence the current study focuses to explore the mosquito repellency of natural plant source such as *Calatropis gigantea*, *Datura metal*, *Andrographis paniculata* and *Carica papaya*. The methanol extracts of these selected herbs were tested for mosquito repellency using the standard cage test method. The *Calatropis gigantea* extract shows the maximum mosquito repellency of  $95 \pm 1.5$  against *Aedes aegypti*. The optimized extract of *Calatropis gigantea* was used for finishing cotton fabrics with two different GSM (Grams per square meter). The finished fabrics were further analyzed for its wash durability up to 20 washes.

**KEYWORDS:** *Aedes aegypti*, mosquito repellent, *calatropis gigantea*, fabric.

## INTRODUCTION

Mosquitoes are not only nuisance but the diseases spread by them cause severe illness to death. It is considered that mosquitoes are ranked high among the other insects in spreading diseases to human being.<sup>[1,2]</sup> Mosquito borne diseases can be witnessed worldwide. There are more than 3000 species of mosquitoes are identified and out of which three variants *Aedes aegypti*, *Anopheles* and *Culex* causes deadly diseases to humans. Usually these kinds of flies ride on the rats, dogs, and other rodents. The major mosquito variant is *Aedes aegypti*. The diseases like dengue, chickengunya, yellow fever caused by *Aedes aegypti*.<sup>[3]</sup> *Aedes aegypti* mosquitoes generally survive indoors and near to people. It rests in cool shaded places in house such as wardrobe, under furniture and laundry areas. Health care is something that safeguards us from sickness and helps us to be healthy from diseases. Textile fabrics get contaminated by many reasons like blood, skin, stool, urine, vomit and other body tissues and fluids. So higher quality and better efficiency in health and medicine has the need in both home and hospital.<sup>[4]</sup> Medicinal plants have attained its important role in health system all over the world herbs are predominant sources of therapeutics or curative aids in recent decades. Herbs are used to treat diseases as well as to maintain good health.<sup>[5]</sup> The herbal plants were chose based on the insect/mosquito repellent property such as *Calatropis gigantea*<sup>[6][7]</sup>, *Datura metal*<sup>[8][9]</sup>, *Carica papaya*<sup>[10]</sup> and *Andrographis paniculata*<sup>[11][12]</sup> were selected. Mosquito repellency finishes are the textile finishes that are given to textile materials to perform against mosquito variants and protects human from any mosquito induced disease. These mosquito repellent materials may be in natural or synthetic forms.<sup>[13]</sup> Synthetic agents are prepared using chemicals, which may contain toxic materials which affects the human skin.<sup>[14]</sup> Health care fabrics are much needed avoid certain health illness caused by mosquitoes and to apply these finishes. Cotton will be the ideal choice for developing such health care material.<sup>[15][16]</sup>

## MATERIALS AND METHODS

### Collection of plants

The fresh leaves of *Calatropis gigantea*, *Datura metal* and *Carica papaya* was collected at Poondi, in Tirupur District. The collected fresh leaves were washed in running tap water to remove the dust materials and allowed for drying *Andrographis paniculata* leaf powder was purchased from the herbal shop at Tirupur District.

### **Preparation of plant extract**

The methanol extract of *Calatropis gigantea* was prepared for 10% concentration and kept for overnight shaking. The extract was filtered and mosquito repellency was analyzed by Cage test method. Similarly other three herbal extract was prepared and tested.

### **Screening the best plant extract for its highest mosquito repellency**

The prepared four herbal extract were screened for their mosquito repellent property. The Screen Cage method (Donald R. Barnard, et al.,)<sup>[18]</sup> was selected for analyzing the mosquito repellency property. The bioassay screening was done using a cage consist of an aluminum frame and covered with stockinet on sides, top and bottom. The host seeking mosquitoes are placed in the cage before an hour of test. The plant extracts were applied on the skin area of forearm includes from wrist to elbow and coated forearm was inserted into the cage.<sup>[19]</sup> Percentage of repellency was calculated through the observation of mosquito behavior and complete protection time. The extract with good repellency was used for fabric finishing.

### **Selection of fabric**

The 100% cotton woven fabric with two different GSM was selected for the study. The GSM selected for study was 220 (low) and 280 (high). The low GSM fabrics are suitable for apparel whereas high GSM fabrics are suitable for home furnishing.

### **Extraction of selected herb**

#### ***Calatropis gigantea* leaves**

The methanol extract of *Calatropis gigantea* with 10% concentration was used for fabric finishing. The dried extracts after complete evaporation of solvents were dissolved in 2% DMSO and used for finishing fabric. The 4% of citric acid was used as a binder in fabric finishing.

### **Fabric finishing by Pad – dry and cure method**

The prepared solution was treated to the fabric with the M:L of 1:20 and the fabric was allowed to remain soaked for 1 hour. The soaked fabric was padded for 15mins in the roller with the air pressure of 50-60 Pa. The finished fabrics were further tested for its mosquito repellency against *Aedes aegypti*. The finished fabrics were further analyzed for its wash durability by 10,20 wash cycles.

### Mosquito repellency activity of finished fabrics: Cage test method

The untreated fabrics treated fabrics were tested for mosquito repellent activity using standard Cage test method.<sup>[8]</sup> The fabric sample of 15x15 inch was cut and placed on the forearm and allowed the hand to be inside the cage. The percentage of mosquito repellency was evaluated by monitoring /observing the mosquito behavior inside the cage. The no of mosquitoes present in the cage, dead and escaped were calculated using the standard formula. Thus the fabric samples of apparel and home furnishing was tested for mosquito repellency.

## RESULT AND DISCUSSION

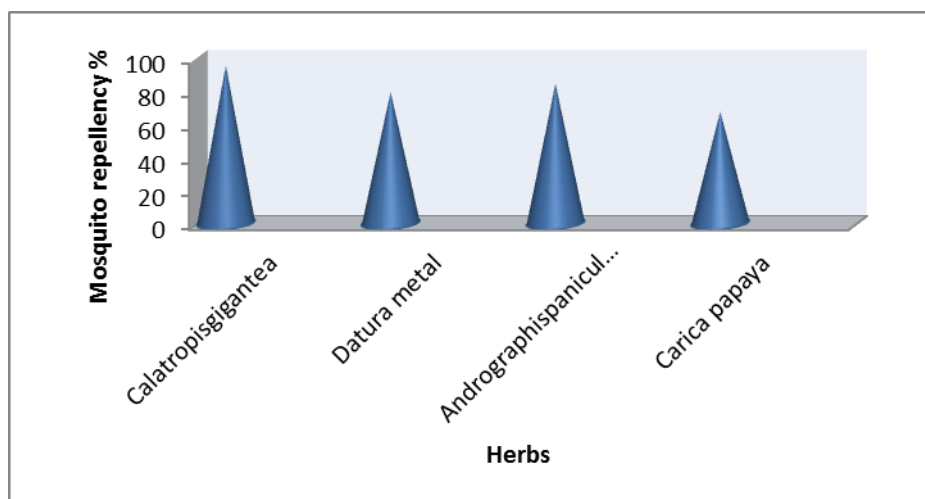
### Screening of Mosquito repellency of methanol extract of selected herbs

The result table –I and figure -1 of mosquito repellent activity of the methanol extracts of four herbs were tested against *Aedes aegypti* mosquitoes. The herb *Calatropis gigantea* leaf extract has shown the maximum activity of  $95 \pm 1.5$  when compared to other three herbs. *Andrographis paniculata*, *Datura metal* and *Carica papaya* has shown the moderate repellency activity against the *Aedes aegypti* mosquito variant.

**Table I: Mosquito repellent activity of methanol extracts of selected herbs.**

Mosquito repellency% against <i>Aedes aegypti</i>	Herbs			
	<i>Calatropis gigantea</i>	<i>Datura metal</i>	<i>Andrographis paniculata</i>	<i>Carica papaya</i>
	$95 \pm 1.5$	$79 \pm 1.0$	$84 \pm 1.2^*$	$67 \pm 1.5$

Note: Values are means  $\pm$  S.D, n = 5, Significant at,  $p < 1.05$



**Figure 1: Mosquito repellency of solvent extracts.**

**Mosquito repellency activity of finished fabrics: Cage test method**

The mosquito repellency of fabrics such as untreated, treated and after washed samples were tested against *Aedes aegypti* mosquito and the results were shown in the Table – II and figure – 2 (A,B,C). The *Calotropis gigantea* treated cotton fabric with 280 GSM shows the highest activity of 84% whereas fabric of 220 GSM results in 78% of mosquito repellency. Further the fabrics were tested for mosquito repellency property after 10, 20 wash cycles. The fabric after washing retained its mosquito repellency till 20 wash cycles.

**Table II: Testing of mosquito repellency activity of Untreated, treated and after wash fabrics.**

S.no	Woven cotton fabrics	No of specimen exposed	No of specimen in the cage	No of specimen escaped	No of specimen dead	Mosquito Repellency (%)
1.	Untreated – 220 GSM	0	0	0	0	0
2.	Untreated – 280 GSM	0	0	0	0	0
3.	Treated – 220 GSM	50	11	34	5	78
4.	Treated – 220 GSM After 10 wash cycle	50	15	27	8	70
5.	Treated – 220 GSM After 20 wash cycle	50	19	25	6	62
6.	Treated – 280 GSM	50	8	38	4	84
7.	Treated – 280 GSM After 10 wash cycle	50	12	31	7	76
8.	Treated – 280 GSM After 20 wash cycle	50	14	27	9	72





**Fig. 2: Testing of mosquito repellency activity of A-Untreated, B - treated and C- after wash fabrics.**

## CONCLUSION

As reported by World Health Organization every year 7 lakhs people die due to so called disease chikengunya and dengue. The deadly diseases caused by *Aedes aegypti* mosquitoes can be controlled by this type of health care textile material. *Calatropis gigantea* has the potential to repel the *Aedes aegypti* mosquito and there are several other sources in nature which also act as insecticidal. So in the present scenario we need mosquito repellent textile materials in both indoor and outdoor. Lower GSM fabric finished would be suitable for apparel and high GSM for Home furnishing. So the herbal plants with potential bioactive compounds can be carefully studied and applied on health care textile materials.

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