

Repellent and Adulticide Activity of *Cinnamomum tamala* (Buch.-Ham.) on Adult Mosquitoes

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Abstract: Bay leaf is having a pungent odor; hence the present study was carried out to investigate its effect on mixed culture of laboratory reared mosquitoes. Powder of leaves was formulated with various binders like wsswhite flour, coco powder, wood powder, cow dung and pure paste. Also combination of clove oil and nilgiri oil were incorporated in the above composition. Along with adulticide and repellent activity, burning time and side effects of present powder along with their composition were analyzed both in laboratory and on field experimentation. The study revealed that pure paste has high mortality rate while White flour binder have low mortality rate. Cow dung binder has high repellent rate while coco powder has low repellent rate. Wood powder and white flour as a binder, pure paste has no irritation while cow dung as binder has little irritation.

Keywords: *Cinnamomum tamala* (Bay leaf), repellent activity, Adulticide activity, side effects

I. INTRODUCTION

Controlling mosquitoes is of utmost importance in the present day condition with rising number of mosquito born diseases. An alarming increase in the range of mosquitoes is mainly due to deforestation, industrialized farming and stagnant water. Thus special products like mosquito repellents for combating mosquitoes are required. The products used for mosquito control have varying degrees of effectiveness. Carbon dioxide and lactic acid present in sweat of warm blooded animals act as an attractive substance for mosquitoes. Mosquito repellent based on chemicals has a remarkable safety profile, but they are toxic against skin and nervous system and bring about a rash, swelling, eye irritation and worse problems, though unusual including brain swelling in children, hence natural mosquito repellents were preferred over chemical mosquito repellents. Present attempt is made to formulate and introduce new active ingredients, especially those derived from natural plants to replace the synthetic pyrethroid for the control of mosquito adults.

Potential of volatile oils extracted from turmeric, citronella grass and hairy basil as topical repellent against both day & night biting mosquitoes has been demonstrated.

The present study was carried out to evaluate repellency of dhoop Sticks derived from leaves of *Cinnamomum tamala*. An attempt has been made to develop a bay leaf based herbal mosquito repellent dhoop Sticks which is more effective, cheap, keeps environment pleasant & health friendly. Using different binders such as coco powder, cow dung, wood powder and white flour etc.

II. MATERIAL AND METHODS

1) Composition

A. Collection of bay leaf

The fresh and healthy leaves of *Cinnamomum tamala* were collected from the spice shop during August 2018. Leaves were washed with distilled water so as to remove dirt and soil particles. Then the dried leaves were grinded with an ordinary grinder. (Fig.1)

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B. Identification

Cinnamomustamala was authenticated by Dr.R.S. Sawant, Associate Professor, Department of Botany.

C. Preparation of Dhoop Sticks

i. Using Nilgiri oil, Clove oil

- 1) Coco powder (20gm) + bay leaf (80gm) + clove oil / nilgiri oil +coconut oil + camphor.
- 2) White flour (20gm) + bay leaf (80gm) + clove oil /nilgiri oil +coconut oil +camphor.
- 3) Wood powder + bay leaf (80gm) +clove oil /nilgiri oil + coconut oil + camphor.
- 4) Cow dung + bay leaf (80gm) + clove oil / nilgiri oil + coconut oil+camphor.
- 5) Pure paste + bay leaf (80gm) + clove oil /nilgiri oil + coconut oil + camphor.

ii. Preparation of bay leaf moulds

Cut leaf pieces were grounded into paste using electrical grinder by adding distilled water.80-100gm of bay leaf pure paste was taken and moulded in dhoop sticks mold. Wet weight and dry weight of dhoop sticks were taken. (Fig.1)



Fig.1: Molds of dhoop sticks

D. Formulation of dhoop sticks using different natural binders

The different natural binders (20gm each) were used like wood powder, coco powder, cow dung, white flour.(Fig.2)



Fig.2: Binder with paste weight

E. Supplementation of bay leaf paste with binders & impregnation with oil

Each dhoop sticks was prepared as 20% (w/w) binders and 80% (w/w) leaf past. The concentration of coconut oil, clove oil or nilgiri oil,camphor are used in 30:1:0.3 ratio respectively.(Fig.3)





Fig.3: Oil

2. Mosquito rearing for repellency

The effect of present formulation was treated against the adult mosquitoes in laboratory as well as on field experimentation. Mosquito larvae were reared in earthen pot and released in glass made tanks in the laboratory condition. Until the formation of pupation waited and after that 25 pupa are transferred to small two liter aerated polythene bottles. After 2-3 days when adults were emerged from the pupa were fed with rat blood. (Fig.4)

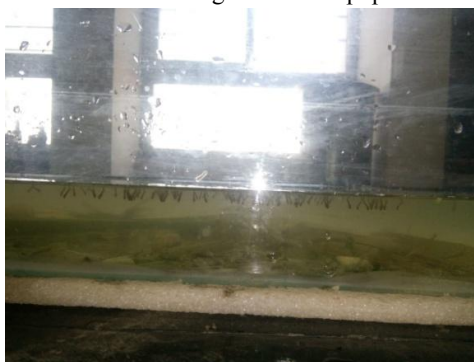


Fig.4: Mosquito larva reared in aquarium.

Experimental Set-up

1) Laboratory condition:

In laboratory condition newly prepared bay leaf dhoop sticks were burned in each bottle so as to access the repellency rate, mortality rate and paralysis rate. Furthermore, the time taken to burn the dhoop Sticks was also observed.

2) On field experimentation:

For investigating mosquito repellent activity, burning time and side effects, 20 houses were selected randomly and supplied with all Dhoop Sticks of various binders (20 samples each). After 24 hours family members were interviewed to check the efficacy of the product.



Fig. 5: Burnt dhoop stick



III.RESULT AND DISCUSSION:

A) Flammability test:

Burning time: To observe repellency test, dhoop stick were burnt using candles and burning time was noted in laboratory and on field experiment (table no.1). The present study concealed that burning time of white flour with nilgiri oil is high i.e.2 hour and burning time of pure pate without oil is low i.e. 20 minute. Usually, for ideal dhoop stick, burning time should not be to high as to low. On the basis of this study except above mentioned sticks all remaining are ideal.

Table No.1-Burning time of dhoop sticks

	Coco powder	Cow dung	Wood powder	White flour	Pure paste
Laboratory observation	1) Nilgiri:1 hr.5 min 2) Clove: 1 hr. 20 min. 3) Pure:1 hr. 29 min.	1) Nilgiri: 47 min. 2) Clove: 45 min. 3)Pure: 45 min.	1) Nilgiri: 45 min. 2) Clove: 40 min. 3)Pure: 25 min.	1) Nilgiri: 2 hr. 2) Clove: 1 hr. 54 min. 3) Pure: 1hr. 57 min.	1) Nilgiri:25 min. 2) Clove: 35 min. 3) Pure: 20 min.
Respondent observation	1) Nilgiri: 10 min. 2) Clove: 12 min. 3) Pure: 9 min.	1) Nilgiri: 15 min. 2) Clove: 12 min. 3)Pure:10 min.	1) Nilgiri: 45 min. 2) Clove: 3 min. 3) Pure:2 min.	1) Nilgiri: 30 min. 2) Clove: 25 min. 3) Pure: 40 min.	1) Nilgiri: 8 min. 2) Clove: 7 min. 3) Pure:6 min.

Irritation:

In the present study, side effects such as eye irritation and skin irritation were due to dhoop sticks burning was noticed from 20 respondents. According to respondents response there was no irritation occurred except one respondent i.e. cow dung as a binder causes eye irritation.

Table no 2-Irritation

	Coco powder	Cow dung	Wood powder	White flour	Pure paste
Laboratory observation	1)Nilgiri=Very less irritation 2)Clove= Very less irritation 3)Pure= Very less irritation	1)Nilgiri=Small irritation 2)Clove= Small irritation 3)Pure= Small irritation	1)Nilgiri=No irritation 2)Clove= No irritation 3)Pure=No irritation	1)Nilgiri=No irritation 2)Clove= No irritation 3)Pure= No irritation	1)Nilgiri=No irritation 2)Clove= No irritation 3)Pure= No irritation
Respondent observation	1)Nilgiri=Very less irritation 2)Clove= Very less irritation 3)Pure= Very less irritation	1)Nilgiri=Small irritation 2)Clove= Small irritation 3)Pure= Small irritation	1)Nilgiri=No irritation 2)Clove= No irritation 3)Pure= No irritation	1)Nilgiri=No irritation 2)Clove= No irritation 3)Pure= No irritation	1)Nilgiri=No irritation 2)Clove= No irritation 3)Pure= No irritation

Residual:

During experiment before burning of dhoop sticks wet weight and dry weight was taken and after burning of dhoop sticks ash weight was taken. The residual percentage was calculated (table no. 3) by using formula.

Residual (%) = Ash weight/ dry weight*100



The high residual percentage suggests incomplete burning of dhoop sticks. One combination gave highest residual percentage, was cow dung with clove oil i.e. 28.96% and lowest residual percentage is white flour without oil i.e. 1.67%.

Table No. 3-Residual percentage

	Coco powder	Cow dung	Wood powder	White flour	Pure paste
Laboratory observation	1)Nilgiri=2.62 2)Clove=3.10 3)Pure=2.69	1)Nilgiri=28.57 2)Clove=28.96 3)Pure=26.22	1)Nilgiri=11.27 2)Clove=17.72 3)Pure=14.28	1)Nilgiri =5.07 2)Clove=2.69 3)Pure=2.15	1)Nilgiri=8.37 2)Clove=4.97 3)Pure=6.80
Respondent observation	1)Nilgiri=2.45 2)Clove=2.90 3)Pure=3.04	1)Nilgiri=19.55 2)Clove=11.29 3)Pure=11.79	1)Nilgiri=15.22 2)Clove=12.06 3)Pure=10.69	1)Nilgiri=2.37 2)Clove=2.03 3)Pure=1.67	1)Nilgiri=5.82 2)Clove=3.86 3)Pure:=6.94

The good stick has characters like moderate burning time without irritation and low residual remains. At the end of study, it can revealed that bay leaf with coco powder have all these characters which have mentioned above. Hence coco powder gives best result.

b) Mosquito Repellency Test:

To observe repellency test dhoop sticks were burnt and mortality rate, repellent rate and paralyzed rate was calculated (table no.4). The present study revealed that extract of *Cinnamomum tamala* showed effect against mosquito. The mortality rate of pure paste with nilgiri oil is high i.e. 69.23 % and the mortality rate of white flour with clove oil is low i.e. 03.70%.

The repellency rate of wood powder with clove oil is high i.e. 53.84% and the repellency rate of pure paste without any oil is low i.e. 23.07%. The paralyzed rate of white flour with clove oil is high i.e. 33.33% and paralyzed rate of white flour with nilgiri oil is low i.e. 04.16%.

Table No.4-Mosquito Repellency Test

	Mortality Rate (%)			Repellent Rate (%)			Paralyzed Rate (%)		
	Nilgiri Oil	Clove Oil	Pure	Nilgiri Oil	Clove Oil	Pure	Nilgiri Oil	Clove Oil	Pure
Coco powder	26.66	12.05	07.14	26.66	37.50	28.56	13.33	12.50	14.28
Cow dung	53.84	40.00	41.17	38.46	50.00	35.29	07.69	10.00	23.52
Wood powder	53.84	15.38	42.10	30.76	53.84	31.57	15.38	30.76	26.31
White flour	12.50	03.70	11.11	41.66	25.92	33.33	04.16	33.33	22.22
Pure paste	69.23	58.82	54.54	23.07	47.36	27.27	07.69	10.52	18.18

C) On Field Analysis : To analyze these dhoop sticks, respondents were randomly selected and checked for quality and usefulness like easy handling of product, safety of product and allergic consequence after use of this product.

1) Respondent's opinion on the quality and usefulness of this product.

Table No.5-Quality and usefulness of this product.

Quality	No. of Respondents	%
Excellent	05	25
Very Good	10	50
Good	05	25
Average	00	00
Poor	00	00
Total	20	



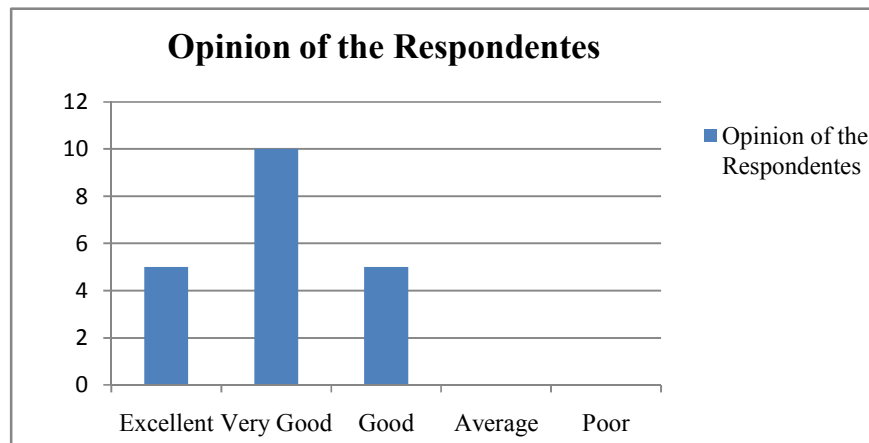


Figure No.6 Quality and usefulness of product.

The present study concealed that 15 respondents are satisfied with quality and usefulness of this product and 5 respondents are partially satisfied. It mean more people are in favor of using this product.

2) Respondent's opinion on easy handling of product.

Table No.6- Easy handling of this product.

	No. of Respondents	Percent (%)
Yes	20	100
No	00	00
Total	20	

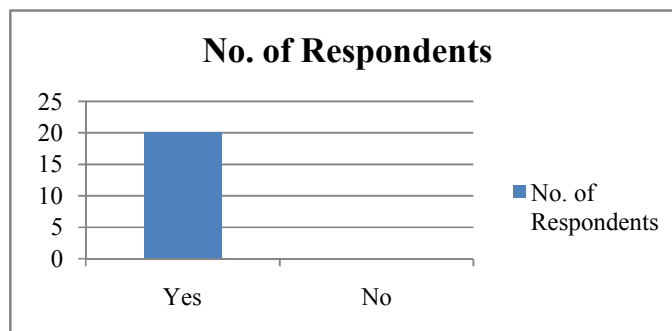


Figure No.7 Easy handling of the product.

The present study revealed that almost all respondents are satisfied with easy handling of this product. The opinion of almost all respondents is favor to easy handling is due to its size, shape, light in weight and non-irritable nature.



3) Respondent's opinion on any allergic consequence/s after use of this product.

Table No.7- allergic consequences of product

	No. of Respondents	Percent (%)
Yes	01	05
No	19	95
Total	20	

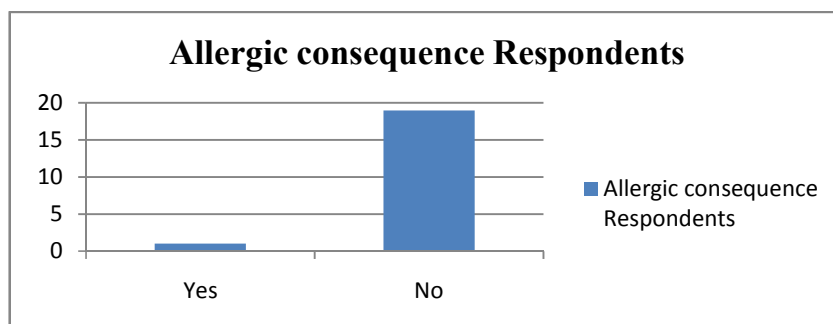


Figure No.8 Any allergic consequence/s after use of product.

Most of the respondents are satisfied without any allergic consequences after use but very few have faced allergic consequences i.e. eye irritation in cow dung as a binder dhoop stick. No any respondent's complaints about allergic consequences except cow dung as a binder. Allergic consequences are not observed due to concentration of oil used or herbal leaves used in present formulation.

4) Respondent's opinion on product safety.

Table No 8- Safety of this product.

	No. of Respondents	Percent (%)
Yes	20	100
No	00	00
Total	20	

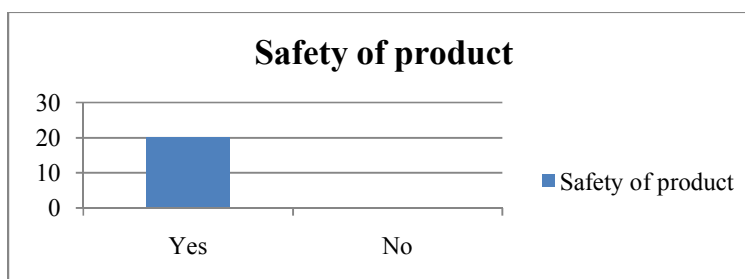


Figure No.9 Safety of product.

The present study revealed that all respondents are satisfied with product for its safety. All respondents noted that product is safe. Safeties of product observed due to the raw materials used are natural leaves in prepared formulation.



IV. CONCLUSION

Currently, the use of synthetic chemicals to control insects and arthropods raises several concerns related to environment and human health. An alternative is to use natural products that possess good efficacy and are environmentally friendly. Among those chemicals essential oil from plants belonging to several species have been extensively tested to assess their repellent properties as a valuable natural resource. Bay leaf remains in the form of dhoop sticks is the first and preliminary report. In addition, the use of other natural products in the mixture, such as binders, could increase the protection time. On the basis of results it can be concluded that the bay leaf dhoop sticks with as an binder and nilgiri/clove oil having less residual percentage, less burning time and irritation is able to repel mosquitoes effectively is the most suitable mosquito repellent .

V. ACKNOWLEDGMENT

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