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Formulation and development of herbal based mosquitoes repellent Dhoop by using *Azadirachta indica* and *Vertex negundo*

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Abstract

Mosquitoes are one of the deadliest insects in the world which cause number of vector-borne diseases (e.g Dengue, malaria, Zika virus fever, yellow fever, West Nile fever, Japanese encephalitis) in human being. In recent years, interest in plant based products has been revived because of the development of resistance, cross-resistance and possible toxicity hazards associated with synthetic insecticides and their rising costs. Presently most of the mosquito repellents available in markets are based on chemical and they are toxic against the skin and nervous system like rashes, swelling, eye irritation, and other health problems. Hence herbal mosquito repellents were preferred than chemical based mosquito repellents. Herbal materials belonging to various plant species and their mixtures have been seen to act as effective repellent against various mosquitoes and pests. The easy availability and less adverse environmental impact have led to the increased interest in plant origin repellants which are safe and biodegradable alternatives to synthetic chemical repellants for use against mosquitoes. Hence attempts have been made to find out the novel formulations containing fixatives with combination of different essential oils for mosquito repellent stick. In this paper an effort has been made to develop economically affordable herbal mosquito repellent sticks comprised entirely of herbal ingredients. Since ingredients used were almost herbal hence it has low side effect on inhalation.

Keywords: Mosquito repellent, formulations, *Azadirachta indica* and *Vertex negundo*

1. Introduction

Mosquitoes are among the most disturbing blood sucking insects afflicting human beings^[1-2]. Several mosquito species belonging to genera Anopheles, Culex and Aedes are vectors for the pathogens of various diseases like Dengue fever, Malaria, Yellow fever, Japanese Encephalitis and several other infections^[3]. Mosquitoes alone transmit diseases to more than 700 million people and over one million deaths are reported annually across the globe^[4-5]. Therefore, the control of mosquitoes is an important public health concern around the world. As most of the mosquito repellent products and devices available in the market are reported to have harmful effects on human beings, the objective of the present study is to develop effective plant-based mosquito repellent dhoop.

2. Materials and Methods**2.1 Herbs and additives used in the formulation****2.1.1 Neem (*Azadirachta indica*)**

This is a widely available plant with many beneficial properties; neem is an effective mosquito repellent and has been used for generations. There are published studies stating that neem is a very effective mosquito repellent. This is due to the compound Azadirachtin, which irritates the mucous membranes of the mosquito and is used as an antifeedant (stops the feeding of the mosquito and it cannot consume human blood meal)^[6-7].

2.1.2 Nochi (*Vitex negundo*)

A large shrub or sometimes a small slender tree; bark thin, grey; branchlets quadrangular, whitish with a fine tomentum. Leaves 3.5- 24.4 foliate; leaflet lanceolate, acute, the terminal 5-10 by 1.6-3.2cm with a petiolule 1-1.3cm long, lateral leaflets smaller with a very short petiolule, all nearly glabrous above, covered with a fine white tomentum beneath, base acute; common petioles 2.5-3.8cm long. Flowers in pedunculate branched tomentose cymes, opposite along the quadrangular tomentoserhachis of a large terminal often compound pyramidal panicle (Axillary peduncles in the upper axils sometimes present); bracts 1.5-2.5mm-long, bluish purple, tomentose outside, hairy inside at the insertion of the stamens; upper lip 2mm.

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long, divided to the base into 2 obtuse lobes; lower lip large, 5mm-long, with 2 short oblong obtuse lateral lobes 1.5mm-deep, and large broadly obovatecrenulate terminal lobe 4mm-long. Filaments hairy at the very base ovary glabrous; style glabrous; stigma forked. drupe less than 6 mm diam., black when ripe.

Purified extracts are believed to have medicinal properties. *Vitexnegundo* is used for treating stored garlic against pests and as a cough remedy in the Philippines, sold under the trade names *Ascof* and *Plemex*. In Malaysia, it is used in traditional herbal medicine for women's health, including treatments for regulating the menstrual cycle, fibrocystic breast disease and post-partum remedies [9].

2.1.3 Camphor

Camphor is originally a white and oily resin of the tree *Cinnamomum camphora*. Its crystals are also widely available in the market. It has been used for generations as an effective repellent of mosquitoes and ants [6-7].

2.1.4 Benzoin

Benzoin Also known as Sambhrani in Southern India, is the resin obtained from the aromatic tree *Styrax* genus. Its odour also repels mosquitoes and it has been used for generations in India, China, etc. as a mosquito repellent [6-7].

2.1.5 Cow Dung

Cow dung contains plenty of Ammonia, Menthol, Phenol, Indole, Formalin and specially its bacteriophage eradicate the pathogens and are recognized disinfectant cow dung collected from local cow farm it was placed expose to air for two days and moisture removed from it [6-7].

2.1.6 Saw dust

Saw dust used in formulation to enhance the combustion process in Dhoop. Saw dust collected from local saw mill and it passed through 40 no sieve to get fine particle [6-7]

The saw dust will be used to enhance the combustion process. Neem leaf powders have strong repellent activity of mosquitoes having good binding property. Fumigation of Camphor for making soothing atmosphere. Essential oil and neem leaves are the most generally used medicinal plants in making of mosquito repellents and has excellent insecticidal property. Processing Materials used [8].

1. Sieve
2. Mortal & pestle
3. Paint brush
4. Weighing machines
5. Measuring cylinder.

3. Result

The formulation containing *Vitex negunda* and neem shows the best result as mosquito repellent. The burning time was also satisfactory. Smoke visibility was high. Aroma was also most pleasant. Ash weight was minimum for this formulation and shows maximum mosquito repellent activity.

Physical Appearance: Colour: Brownish or Darkbrown

Table 1: Evaluation Parameters of Herbal Mosquito Repellent Dhoop.

S. No	Parameters	Herbal dhoop
1.	Burning time	10
2.	Odor	Satisfactory
3.	Irritation	No
4.	Smoke Visibility	High
5.	Ash weight (g)	0.97
6.	Mosquito repellent activity (mins)	8

Table 2: Evaluation of Sensory Analysis

S. No	Questions	Yes	No
1.	Is the smell appreciable?	34	1
2.	Smoke is irritating	3	32
3.	Use the product at home	34	1
4.	will you recommend the product	35	0
5.	Resinous smell?	33	2
6.	Minty smell?	34	1
7.	Relief from nasal congestion?	15	20



Fig 1: Neem



Fig 2: Nochi



Fig 3: Saw dust



Fig 4: Benzoin



Fig 5: Camphor



Fig 6: Round agal shaped mosquito repellent



Fig 7: Cone shaped mosquito repellent

4. Discussion

In this study, an attempt is done to prepare herbal based mosquito repellent dhoop using cow dung as fillers along with herbal powder of *Vitex negunda* and neem. Also supporting excipients are added to the preparation. Here, the herbal powder is tested as mosquito repellent dhoop. Evaluation parameters of herbal mosquito repellent dhoop are

shown in Table 1. It contains burning time (minute), smoke visibility, odor, irritation test, ash weight (g.) and mosquito repellent activity. Smoke visibility shows the volume of smoke released from the mosquito repellent dhoop and gives an idea that natural mosquito repellent and natural pesticides is always better than synthetic preparations.

The formulation is also tested in mosquito affected areas. At burning time, it was observed that up to 70% of mosquito number was greatly decreased. Formulation containing *Vitex negunda* powder along with neem powder and cow dung shows maximum effectiveness in reducing mosquito number. Also aroma of this formulation was most satisfactory. That's why use of natural mosquito repellent dhoop is more holistic and better option than synthetic mosquito repellent as it is more effective as well as environmental friendly also.

5. Conflict of interest

There are no conflicts of interest.

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