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Traditional medicinal practices for mosquito repellency by tribes of west central India: An overview

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Abstract

Mosquito population has spread all around the world except Iceland, Antarctica and few smaller islands, where there is no possibility for mosquitoes to breed. Mosquitoes generally desire to reside at humid, dark and warm places to reproduce. Mosquitoes have become the major nuisance to the society in spreading different diseases like dengue, malaria and many other diseases which causes around 1 million deaths of people according to WHO. Many trials were being made to control the population of mosquitoes like eliminating the breeding places, rearing of predator fishes which mainly depend on the larvae of mosquitoes, introducing large number of sterile males and genetic methods including cytoplasm incompatibility. Apart from this control measures, many mosquito repellents are available in the market to protect people from mosquitoes bites. Repellents are available in many forms like spatial, chemical, natural and gadgets which can repel mosquitoes. Now a days people have become health conscious and are concentrating on natural repellents and natural ways of repelling mosquitoes. Many plant species having mosquito repellent properties are aboriginal to tropical regions. Many companies are using these plant sources as a base for production of mosquito repellent products. In west central India there are no of plant species that are used for personal protection against mosquitoes by tribes. Through the present review 55 plant varieties belonging to different families were reviewed from secondary data which were proven to be used as repellent sources by tribes of Maharashtra, Chhattisgarh, Jharkhand, Bihar, Madhya Pradesh, Gujarat, Rajasthan and Haryana against host seeking mosquitoes. The plant species used in almost all tribal areas of the above mentioned states are *Vitex negundo* Linn, *Ocimum Basilicum* Linn, *Eclipta alba* (L.) and *Lantana camera* (L.) in different forms like hanging the dried plant stems above the entrance doors and windows, application of plant extracts on the exposed body parts and the fog of the burned plant parts is used to drive away the mosquitoes.

Keywords: mosquito repellents, west central India, tribal practices, medicinal plants for mosquito repellency

1. Introduction

It was proven fact that the mosquitoes can detect carbon dioxide from as long as 150 feet. The skin of people who sport with sweat and lactic acid, heat that is radiated from person's body, movement of the person by detecting changes in light waves and other odors emitted from the persons skin are the major attractants of mosquitoes. Apparently 20 percent of the people are more likely to be bitten by mosquitoes based on genetic and unchangeable factors such as Type O blood group, fast metabolisms of cholesterol through which by-products are expelled through skin surface, those with higher body temperatures, Pregnant and lactating women who have a higher average body temperature and those people who release a lot of steroid by-products from uric acid, lactic acid, and ammonia through sweat glands of skin. Things that are used to repel mosquitoes in any form are called as mosquito repellents. mosquito repellents are available in the market in many forms such as spatial repellents like dhoop sticks, vaporizers, repellent coils, mosquito repellent papers etc, chemical repellents like DEET based and Permethrin based creams and lotions and gadgets based on high frequency ultra sounds like buzzers, mosquito traps etc. More over these synthetic based repellents are very carcinogenic to human body and poses many health issues like skin cancer, lung cancer and other diseases. Whatever the form it may be, mosquitoes have become so clever to adapt themselves to the repellent practices followed by man and in no time they get resistant to repellent products. Keeping in mind, all these disadvantages, people have become more conscious about their health and are concentrating more on natural and indigenous medicinal practices as a personal protection against mosquitoes, as these are perceived as safe in comparison to synthetic repellents. Knowledge based on indigenous repellent practices is also helpful in developing new natural products and several appealing features such as biodegradability, less harm to the environment gives these practices a remarkable asset. M

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Majority of tribes and villagers concentrate extensively on plant based repellents because for poorest communities these plant based repellents are considered as safe and trusted means of protection from mosquito bites (Koul *et al.*, 2008) [8].

1.1 Review on mosquito repellent plant sources used by tribes of west and central parts of India

Repellency of plant material has been exploited for thousands of years by man, most simply by hanging bruised plants in houses, a practice that is still in wide use throughout the developing countries. Plants have also been used for centuries in the form of crude fumigants where plants were burnt to drive away nuisance mosquitoes and later as oil formulations applied to the skin or clothes which was first recorded in writings by ancient Greek, Roman and Indian scholars. Plant-based repellents are still extensively used in this traditional way throughout rural communities. Tribals dwelling in remote

places depend on the forest that includes rich diversity of flora and fauna to meet their lively hood and health care needs (Chopra *et al.*, 1986; Kadhivel *et al.*, 2010) [6]. Herbal medicines have been used by them since antiquity in treating diseases. However, valid scientific data on the usage of ethnomedicinal plants is rather obscure. Recent, (Schmidt *et al.*, 2009) experiments proven that plants offer immense scope for researchers engaged in validation of traditional claims for the development of novel drugs. Since interest in traditional medicine have been increasing world over, ethnobotanical studies have gained prominence to explore the traditional knowledge particularly in developing countries (Joshi and Joshi, 2000). Therefore, collection of ethnobotanical information and documentation of traditional knowledge has gained prominence from the prospective of drug development (Ragupathy *et al.*, 2008)

Table 1: Plant sources used by different tribes of West and Central parts of India for Mosquito Repellency

Sl. No.	State	Tribes	Plant Sources	Family	Common Name	Form of Usage
1.0	Maharashtra Sarit <i>et.al</i> (2015)	Agaris, Bhils, Dhodias, Dublas, Kathkaris or Kathodias, Kolis, Konkanis, pharaphdis, Raikares, Ramoshis, Thakurs, Vardaris, Vaghris and Varlis- Tribes of Maharsatra	<i>Adhatoda Zeylanica</i> Medic. Adulsa	Acanthaceae	Malabar nut.	Juice extracted from leaves applied externally
			<i>Blumea eriantha</i> DC	Asteraceae	Blumea	Strong smell of leaf juice sprayed inside the house
			<i>Blumea Lacera</i> (Burm.f.) DC	Asteraceae	Blumea	Juice extracted from leaves applied externally
	Bagul (2013)	Satpuda forest	<i>Leucas nutants</i>	Libiatea	Common Leucas	Whole plant is dried and burnt to make fog and this fog/smoke acts as mosquito repellent in huts
	Pawar <i>et.al</i> (2008)	Jalgaon District	<i>Catunaregam spinosa</i> (Thunb.) Trivengadam	Rubeaceae	Mountain Pomegranate.	Extracts of fruit are applied on skin
			<i>Eucalyptus globules</i> Labill.	Myrtaceae	Southern blue gum, Blue Gum,	Leaf juice is applied externally on exposed body parts
			<i>Vitex negundo</i> L.	Verbenaceae	Chaste Tree	Twigs of plant are hung inside huts
	Patil <i>et.al</i> (2006)	Nasik District	<i>Ocimum Basilicum</i> Linn	Labiatae	Sweet Basil	Essential Plant oil is applied on skin. Whole plant Kept /Hung in house
			<i>Ocimum gratissimum</i> Linn	Labiatae	Ram tulas	Essential oils extracted from leaves is applied on skin.
			<i>Ocimum tenuiflorum</i> L	Labiatae	Tulsi	Leaves yields essential oils which when applied on external body parts acts as mosquito repellents
2.0	Chattisgarh Tirkey <i>et.al</i> (2014)	Dugli, Lamni, Ataria, Keochi, Dhamtari, Keregaon, Nagri and Singhpur tribes	<i>Cymbopogon winterianus</i>	Poaceae	Citeronella Lemon grass	Plan itself acts as mosquito repellent and the essential oils derived from plant parts acts as mosquito repellent.
			<i>Euphorbia milli</i> Des.	Euphorbiaceae	Crown-of- Thorns	Fumigants from the whole plant when burnt acts as mosquito repellent
	Chandra prakash <i>et.al</i> (2009)	Surguja district Tribes- Kete, Ghatbarra, Parsa, Tara, Pendrakhi, Parogia, Hariharpur, Shivnagar, Fatepur and Bhandargaun	<i>Chloroxylon swietenia</i> DC	Rutaceae	East Indian Satin wood	Application of Essential oils extracted from leaves on exposed body parts
3.0	Jharkhand Barla <i>et.al</i> (2015)	Munda, Ho, Santhal, Oroan and Kharia	<i>Ocimum basilicum</i> linn	Lamiaceae	Sweet Basil	Smoke is created (by burning dried plants) and the smoke acts as mosquito repellent
			<i>Pongamia</i>	Fabaceae	Indian beech	Oil extracted from seeds is

			<i>pinnata</i> , Pierre.			used for burning lamp to drive away all kinds of insects and mosquitoes
	Niharika <i>et.al</i> (2015)	Tribals in and around Ranchi	<i>Azadiracta Indica</i> A.Juss	Meliaceae	Neem	Fumigants from burnt dried/Fresh leaf along with dried cow dung acts as mosquito repellents
			<i>Dalbergia sissoo</i> DC	Fabaceae	North Indian rose wood	Fumigants from whole dried plant acts as mosquito repellent. Juice of the plant is applied externally on body parts to repel mosquitoes.
	Marandi <i>et.al</i> (2014)	Oraon Tribals of Latehar District of Jharkhand	<i>Pongamia glabra/ Pongamia pinnata</i> (Linn.) Pierre	Fabaceae	Indian Beech.	Seed oil is applied on body for avoiding mosquito bite
			<i>Vitex negundo</i> Linn	Verbenaceae	Five leaved chaste tree	Dry leaves are burnt inside the house to repel mosquito.
	Ashutosh <i>et.al</i> (2008)	Birhore tribes of Jharkhand	<i>Vitex negundo</i> L	Verbenaceae	Five leaved chaste tree	Dried leaves are burnt and the fumes repel mosquitoes.
4.0	Bihar Upadhyay <i>et.al</i> (1998)	Tribes of Bihar	<i>Adhatoda Zeylanica</i> Medic. Adulsa	Acanthaceae	Malabar nut.	Leaf Juice is externally applied on exposed body parts
			<i>Vitex negundo</i> L.	Verbinaceae	Five leave chaste tree	Dried Leaves burned along with dried cow dung and this smoke acts as a repellent
5.0	Madhya Pradesh Amitha <i>et.al</i> (Dec 2014)	Chitrakoot region of Madhya Pradesh	<i>Ageratum conyzoides</i> (L.)	Compositae	Goat Weed	Leaves
			<i>Allium sativem</i> (L.)	Alliaceae	Garlic	The bulbs are used and an essential oil is also extracted.
			<i>Annona squamosa</i> (L.)	Annonaceae	Seethaphal/Sugar Apple	Leaves
			<i>Artemisia abrotanum</i> (L.)	Asteraceae	Worm wood/Moshipatri	Leaves
			<i>Artemisia arborescens</i> (L.)	Asteraceae	Indian worm wood/Masipatri	Leaves
			<i>Azadirecta indica</i> (L.)	Meliaceae	Neem	Leaves
			<i>Calamintha acinos</i> (L.)	Lamiaceae	Thyme basil	Whole herb
			<i>Cassia fistula</i> (L.)	Caesalpinaceae	Amaltas/Rella	Leaves
			<i>Citrus sinensis</i> (L.)	Rutaceae	Orange	Fruit peels
			<i>Clinopodium nepeta</i> (L.)	Lamiaceae	Calamint	Whole herb has a sweet aromatic odour and an infusion of the dried leaves
			<i>Colotropis procera</i> (L.)	Asclepiadaceae	Oak/Erra jilledu	Leaves
			<i>Curcuma aromatica</i> (L.)	Zingiberaceae	Wild Turmeric, Kasturi Pasupu(Telugu)	Whole herb use
			<i>Cymbopogon citrates</i> (L.)	Poaceae	Lemon grass	Leaves
			<i>Cymbopogon nardus</i> (L.)	Poaceae	Citronella	The stem is cut of at ground level and the oil is extracted.
			<i>Eclipta alba</i> (L.)	Asteraceae	False Daisy/Bringaraj	Leaves
			<i>Eucalyptus globules</i> (L.)	Myrtaceae	Eucalyptus	The mature Leaves and essential oil.
			<i>Eugenia caryophyllata</i> (L.)	Myrtaceae	Clove	Undeveloped flowers.
			<i>Ficus banghalensis</i> (L.)	Moraceae	Banyan tree/ Marri chettu	Leaves
			<i>Hyptis suaveolens</i> (L.)	Lamiaceae	American Mint/Bush Mint	Leaves
			<i>Jacobaea vulgaris</i> (L.)	Asteraceae	Tansy	Leaves and flower
			<i>Jatropa curcas</i> (L.)	Euphorbiaceae	physic nut/adavi amudam	Leaves

			<i>Lantana camera</i> (L.)	Verbinaceae	Wild sage/ Pulikampa	Leaves
			<i>Lavendula angustifolia</i> (L.)	Lamiaceae	English lavender	Fresh and dried Flower are used as well as an essential oil.
			<i>Mentha piperita</i> (L.)	Lamiaceae	Peppermint/Pudina	Leaves
			<i>Mentha pulegium</i> (L.)	Lamiaceae	Pudina	Leaves
			<i>Monarda punctata</i> (L.)	Lamiaceae	Horse mint	Leaves
			<i>Ocimum americanum</i> (L.)	Lamiaceae	Tulsi	Leaves
			<i>Ocimum gratissimum</i> (L.)	Lamiaceae	Basil/ Nimma tulsi	Leaves
			<i>Piper nigrum</i> (L.)	Piperaceae	Black pepper/Miryalatige	Leaves
			<i>Psidium guajava</i> (L.)	Myrtaceae	Guava/ Jamapandu	Leaves
			<i>Ricinus communis</i> (L.)	Euphorbiaceae	Castor bean plant	Fruit peels
			<i>Rosemarinus officinalis</i> (L.)	Lamiaceae	Rosemary/Uttareni	Leaves
			<i>Salvia officinalis</i> (L.)	Lamiaceae	Sage/	Leaves
6.0	Gujarat Jagtap <i>et.al</i> (2008)	Pawra tribe of Nandurbar district	<i>Bosewellia serrata</i> Roxb. Ex Colebr.	Burseraceae	salai	smoke is taken on to skin for mosquito repellency
7.0	Rajasthan Santosh, (2012)	Tribes of Rajasthan	<i>Commiphora wightii</i> or <i>Commiphora mukul</i> (Guggul)	Burseraceae	Guggul. Gugul, Mabisaksh, Maisakshi (Telugu)	Resin Incense was burned to repel mosquitoes.
			<i>Vetiveria Zizanioides</i> (Linn)/ <i>Chrysopogon zizanioides</i> (L)	Poaceae/Gramineae	Vetiver, Khas Khas, Khus. Kuruveeru, Vettivelu, Vettiveeru (Telugu)	Oil extracts from the plant contains Vetivone, Zinanal and Epizizizanal. Zinanal and Epizizizanal. The oil when applied externally acts as mosquito repellency
8.0	Haryana Vashistha <i>et.al</i> (2013)	Ambala District, Haryana	<i>Coronopus didymus</i> (L.) Sm.	Brassicaceae	Swine cress	Fumigants from the whole plants parts acts as insect repellent.
			<i>Erigeron linifolius</i> Willd.	Asteraceae	Flax- leaf fleabane, Wavy- leaf flea bane	Seed is aromatic and insect repellent.

A variety of plant species can repel mosquitoes in much effective way, studies that concentrate on identifying these plant species should be carried out. Phyto compound analysis can be carried in identifying repellent compounds that help in mosquito repellency as these compounds can be isolated and used in the production of new natural repellent products that acts as a safer alternative. However the plant parts that acts as repellent need to be sustainable. The parts used for development of new repellent products should be fast-growing, naturally abundant and easy to cultivate like leaves, bark, flowers rather than the parts which when removed will damage the plant. Abundance, and survival after parts have been harvested, is important for sustainability, because useful plants may become scare due to over-harvesting. The plant parts utilized also need to be available when needed, or be easy to harvest and store.

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