

FIELD STUDIES ON THE MOSQUITO REPELLENT ACTION OF NEEM OIL

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Abstract. Repellent action of neem oil was evaluated against different mosquito species. 2% neem oil mixed in coconut oil provided 96-100% protection from anophelines, 85% from *Aedes*, 37.5% from *Armigeres* whereas it showed wide range of efficacy from 61-94% against *Culex* spp. Therefore, neem oil can be applied as a personal protection measure against mosquito bites.

INTRODUCTION

Many plants are known to produce chemicals with insecticidal properties which are environmentally safer compared to synthetic chemicals. Among the most promising is neem (*Azadirachta indica*) which has attracted world-wide attention because of its value in pest control and application in the treatment of many diseases of man and animals. Recently neem has attracted lot of interest due to its antilarval and mosquito repellent properties as an alternative to synthetic pyrethroid impregnated mats and coils. Recent studies have revealed that neem oil impregnated mats are more effective than mats containing synthetic pyrethroids (Sharma *et al*, 1993a). We report the results of field studies on the repellent action of neem oil against different mosquito species.

MATERIAL AND METHODS

Studies were carried out at three different places viz; Dhanori and Ismilepur villages and mango orchards near BHEL complex all in Hardwar District (UP). These sites were selected because of predominance of different mosquito species at these places. Ten human bait collections were carried out in the months of December to March, 1993 in the evening hours between 1730 to 1830 hours to study the repellent action of neem oil against *Aedes albopictus*, *Ae. aegypti*, *Armigeres* spp and *Culex quinquefasciatus*.

Commercial neem oil marketed by Unjha Ayurvedic Pharmacy, Gujarat, India, was used in the experiment. 2% neem oil was prepared by mixing in coconut oil. The experimental human bait was applied with 3 to 5 ml of 2% neem oil uniformly massaged over face, arms and legs. The control human bait was given application of only coconut oil. These volunteers were allowed to sit on the ground at a distance of about 200 m from each other. Two insect collectors were deputed one on each bait to collect all the mosquitos landing on the exposed treated body parts with the help of suction tube and a flash light.

Similarly 16 cattle bait collections were carried out during the period of November, 1992 to June, 1993 to study the repellent effect of neem oil on other anopheline species. The study was carried out keeping in view that cattle attract more anopheline species than humans because of the zoophilic behavior of majority of anophelines. Legs of experimental cattle bait were applied with a massage of 2% neem oil mixed in coconut oil. About 5-10 ml of oil mixture was used for application on one cattle bait depending upon size of the animal. The control cattle bait was given application of coconut oil only. All mosquitos probing to bite or biting the applied portion of the legs were captured during the whole night starting from 1800 to 0600 hours. All the collected mosquitos were identified and tabulated. The percentage protection was calculated by the following formula :

$$\% \text{ protection} = \frac{C - T}{C} \times 100$$

Where C denotes the number of mosquitos collected in controls and T stands for the number collected in experimental subjects.

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RESULTS AND DISCUSSION

The results of field trials for evaluation of mosquito repellent action of neem oil on human volunteers are shown in Fig 1. The results indicate that 2% neem oil was effective in providing 85% protection against *Aedes albopictus*, *Ae. aegypti*; 37.5% against *Armigeres* spp; 61% against *Culex quinquefasciatus* mosquito bites with an overall protection of 73% from total mosquitoes of these species. All these mosquito

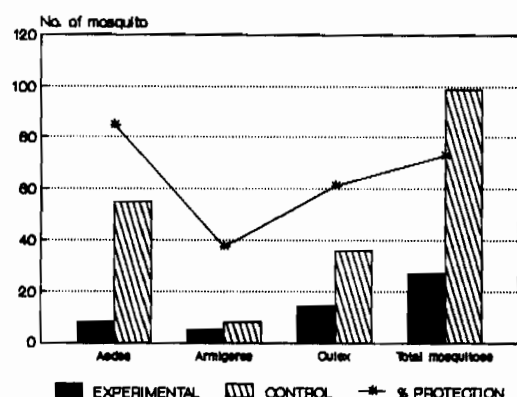


Fig 1—Repellent effect of 2% neem oil against *Aedes*, *Armigeres* and *Culex* mosquitoes on human bait.

species are highly anthropophilic and create a lot of nuisance. Moreover, *Ae. aegypti* and *Cx. quinquefasciatus* are important vectors of dengue hemorrhagic fever (DHF) and filariasis, respectively.

Table 1 gives the results of cattle bait collections carried out to evaluate effectiveness of neem oil as a repellent for anopheline species. The results shows that 2% neem oil provided 100% protection against *Anopheles fluviatilis*, *An. subpictus*, *An. nigerrimus* and *An. splendidus* whereas it was 99.4% effective against *An. culicifacies* and *An. annularis*. It provided 96% protection against *An. stephensi* and 99.3% for total anophelines. For *Culex* sp it was 94% effective with an overall protection of 97.5% against anophelines and culicines. The study indicated that repellent action of neem oil was more pronounced on *Anopheles* mosquitoes than *Culex*, *Aedes* and *Armigeres*. The difference is mainly due to differential feeding behavior of these mosquitoes. Earlier studies have shown that neem oil repelled the anopheline mosquitoes throughout night and there was complete protection from mosquito bites (Sharma *et al*, 1993b). Similarly mats impregnated with 5-10% neem oil provided 80 to 90% protection from mosquito bites thus showing better results than allethrin mats commercially available in the market (Sharma *et al*, 1993a).

Table 1

Results of field trials for evaluation of mosquito repellent action of neem oil* on cattle bait.

Sl No.	Species	Cattle bait		% Protection
		Experimental	Control	
1.	<i>An. culicifacies</i>	2	353	99.4
2.	<i>An. fluviatilis</i>	0	51	100
3.	<i>An. stephensi</i>	2	50	96
4.	<i>An. annularis</i>	1	174	99.4
5.	<i>An. subpictus</i>	0	4	100
6.	<i>An. nigerrimus</i>	0	8	100
7.	<i>An. splendidus</i>	0	64	100
Total Anophelines		5	704	99.3
8.	<i>Culex</i> spp	21	340	94
Total mosquitoes		26	1,044	97.5

* 2% Neem oil in coconut oil

During implementation of bioenvironmental control strategy at Bharat Heavy Electricals Ltd (BHEL), Hardwar (Dua *et al*, 1988), it was observed that a large number of industrial scraps and tree holes were responsible for the breeding of *Aedes*, *Culex* and *Armigeres* thereby creating lot of mosquitos nuisance over the complex. Biological control measures with the help of Bactoculicide (*Bacillus thuringiensis*) were effective for such habitats (Dua *et al*, 1993) but it has some limitations. Similarly there was increase in anopheline density during monsoon because of seasonal river and formation of temporary breeding habitats. The present studies have shown that neem oil is effective in providing protection from mosquito bites. Factory workers can make use of neem oil to protect themselves from bites of *Aedes* and *Armigeres* in the factory premises whereas it can be widely used during monsoon season to repel anopheline mosquitos and can serve as an additional measure for personal protection.

The currently used methods of personal protection from mosquito bites such as synthetic pyrethroid impregnated mats and coils (Birley *et al*, 1987), impregnated nets and ropes (Sharma *et al*, 1989) provide 60-80% protection from endophilic mosquitos (Ansari *et al*, 1990) but the relative efficacy of each method varies considerably (Curtis *et al*, 1987). Moreover prolong exposure to smoke emitted by synthetic pyrethroids may produce harmful effects (Liu *et al*, 1987), hence require standardization and quality control (Coene *et al*, 1989). Neem oil combines all the beneficial properties of a good mosquito repellent. The neem alkaloids are safe and non-toxic to humans (Bhide *et al*, 1958).

The medicinal and antifeedant or insecticidal properties of neem have been known for centuries. Neem juice in various combinations are recommended for intestinal worms, jaundice, skin disorder. Neem-leaves are used to prevent infections. Neem oil is anti-fungal, antiseptic and anti-pyretic. Neem is also a good antifeedant for agricultural pests (Gill and Lewis, 1971). In India, neem trees are available everywhere. One neem tree is estimated to produce 50 kg of seed in a season and one metric ton of seeds yield about 140 kg neem oil (Kandaswamy and Raveendran, 1987). The oil is priced between Rs 20 to 30/kg and the cost of one application (neem + coconut oil) comes to about Rs 0.25, hence providing a very cheap method of personal protection from mosquito bites as compared to other available devices in India.

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