

## Short Report

## Long-lasting anti-mosquito efficacy of a commercially impregnated bed net

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**Keywords:** malaria, control, impregnated bed nets, deltamethrin, *Anopheles gambiae*, Côte d'Ivoire

## Introduction

Since the pioneer work of DARRIET *et al.* (1984), insecticide impregnated bed nets have clearly proved their efficacy in reducing malaria transmission and morbidity (GREENWOOD & BAKER, 1993; CHOI *et al.*, 1995; LENGELER *et al.*, 1996) and even overall infant mortality (BINKA *et al.*, 1996; NEVILL *et al.*, 1996), and are now considered to be an efficient tool for malaria vector control if used on a large scale (CURTIS, 1990; WHO, 1993).

One of the key issues for their use on a large scale is the impregnation itself (and reimpregnation), which needs technical skills and material which may not always be available (LINES, 1996). Some commercial companies will therefore deliver nets which are already impregnated with permethrin or deltamethrin as requested.

We received a batch of such pre-treated bed nets, impregnated with Moskitul® (deltamethrin, 25 mg active ingredient/m<sup>2</sup>), on 6 June 1992. Moskitul® is widely used by the French army. We performed some standard bioassays which demonstrated the efficacy of the nets against *Anopheles gambiae* in Cameroon (unpublished observations). Some of these nets were kept in their original white opaque plastic bags for further tests. Subsequently resistance of *A. gambiae* to pyrethroids was clearly demonstrated in Côte d'Ivoire (ELISSA *et al.*, 1993; CHANDRE *et al.*, in press).

## Materials and Methods

In 1997-1998, 5-6 years after its impregnation, we tested the residual efficacy of one of these nets against the following 4 strains of *A. gambiae*: 2 strains reared in our insectary—Kisumu, susceptible to permethrin, and Kou, selected for permethrin resistance (DARRIET *et al.*, 1997); and 2 'wild' strains, Mbé, a susceptible strain and Yaokoffikro, a resistant strain, mainly resistant to permethrin but also with cross resistance, at different levels, to other pyrethroids (CHANDRE *et al.*, in press). For tests on the 'wild' strains, we used adults emerging in our laboratory from larvae collected in the field.

We performed standard 3 min contact bioassays with 3-5 d old female mosquitoes, fed with sugar only, in WHO cones (3 specimens/test). The cones were attached to the side of the net which was hung over a bed. The exposed mosquitoes were then kept in our insectary at 26°C and 75% relative humidity for 24 h. All tests were done with the Moskitul®-treated net and an untreated control net.

## Results

705 *A. gambiae* females were tested, 384 against Moskitul® and 321 against the untreated control net (Table). The overall 24 h mortality with the control net was <5%.

## Conclusions

(i) More than 5 years after having been treated, and kept in its original opaque plastic bag, the Moskitul®-

**Table. Bioassay of different strains of *Anopheles gambiae* with treated and untreated bed nets**

Mosquito strain	Bed net	No. of mosquitoes		
		Tested after 3 min	Knocked down	Dead at 24 h
<b>Susceptible<sup>a</sup></b>				
Kisumu <sup>c</sup>	Treated <sup>b</sup>	92	35 (38%)	92 (100%)
	Untreated	76	0	6 (7.9%)
Mbé <sup>d</sup>	Treated <sup>b</sup>	102	7 (6.9%)	102 (100%)
	Untreated	84	0	4 (4.8%)
<b>Resistant<sup>a</sup></b>				
Kou <sup>c</sup>	Treated <sup>b</sup>	100	0	35 (35%)
	Untreated	93	0	2 (2.1%)
Yaokoffikro <sup>d</sup>	Treated <sup>b</sup>	90	11 (12.2%)	49 (54.4%)
	Untreated	68	0	4 (5.9%)

<sup>a</sup>To permethrin.

<sup>b</sup>With Moskitul® (deltamethrin, 25 mg active ingredient/m<sup>2</sup>, >5 years previously).

<sup>c</sup>Laboratory colony.

<sup>d</sup>Wild stock.

treated net was still completely effective against the susceptible strains of *A. gambiae*, both laboratory-bred and 'wild'.

(ii) The net was also partially effective against permethrin-resistant strains, both laboratory bred and 'wild' (the latter strain had a frequency of 78.0% [ $n=30$ ] of the resistance gene *kdr* [P. Guillet, personal communication]), with *c.* 35% and 55% mortality after 24 h, respectively.

(iii) Some knock-down effect was observed with the susceptible *A. gambiae* Kisumu strain (*c.* 40% in 3 min), and also with the susceptible and permethrin-resistant 'wild' strains.

The relative efficacy of this 5 years old net even against 'wild' permethrin-resistant *A. gambiae* suggests that similar nets should be tested at village level to evaluate their efficacy for malaria control even in places where the *A. gambiae* population appears to have developed some degree of resistance to permethrin.

## Acknowledgements

We thank Mr A. Monti for kindly providing the Moskitul®-treated bed nets.

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Received 16 March 1998; accepted for publication 15 April 1998

## Announcements

### ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE Denis Burkitt Fellowships

The Denis Burkitt Fund was set up by his family in memory of Denis Burkitt, FRS, who died in 1993; it is administered by the Royal Society of Tropical Medicine and Hygiene.

Two Fellowships (maximum value £3000 each) are awarded annually for practical training, travel, or direct assistance with a specific project (preferably clinico-pathological, geographical or epidemiological studies of non-communicable diseases in Africa).

Applications must be made at least six months before the commencement of the proposed study (by 15 March or 15 September in each year). A short report on the study should be submitted, within one month of the recipient's return. Application forms are available from the Administrator, Royal Society of Tropical Medicine and Hygiene, Manson House, 26 Portland Place, London, W1N 4EY, UK; fax +44 (0)171 436 1389, e-mail mail@rstmh.org

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The fund, in memory of the great leprologist Rochert Cochrane, is administered by the Royal Society of Tropical Medicine and Hygiene. It is used to finance up to three travel fellowships each year to a maximum value of £1000 each.

The Fund will support travel for

\*\*Leprosy workers who need to obtain practical training in field work or in research

\*\*Experienced leprologists to provide practical clinical training in a developing country

There is no restriction on the country of origin or destination providing the above requirements are met.

Applications must be made at least six months ahead of the proposed trip, sponsored by a suitable representative of the applicant's employer or study centre and agreed by the host organization. A short report on the travel/study should be submitted, within one month of the recipient's return. Application forms are available from the Administrator, Royal Society of Tropical Medicine and Hygiene, Manson House, 26 Portland Place, London, W1N 4EY, UK; fax +44 (0)171 436 1389, e-mail mail@rstmh.org

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