

FIELD TEST FOR A NEW SOAP-TYPE REPELLANT AGAINST MOSQUITOES 1/ , 2/

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1/ Commercial names are only used for identification purposes, without implying quality or endorsement.

2/ The concepts here expressed are the responsibility of the authors and they do not represent the opinion of the Ministry of Health or the Organización Panamericana de la Salud.

INTRODUCTION

The last decade has seen a resurgence in the interest for the development of effective means of personal protection against mosquito bites. Field tests using clothing impregnated with permethrin have demonstrated its value against mosquitoes and other biting insects (1,2,3,4). Recent experiments have proved the efficiency of permethrin impregnated canopies to repel anopheles, compared with un-treated canopies (5).

The development of the repellent N,N-diethyl-m-toluamide (deet) has led to believe that the best product was available. Today, deet is one of the most widely used compounds for the manufacture of repellents (6,7).

This study was conducted to determine, in local populations, the efficiency of two repellent formulations to reduce mosquito biting or the percentage of repellency and residual effects of both formulations.

METHODS AND MATERIALS

This study was conducted in 34 rural locations of the provinces of Meta, Casanare, Norte de Santander and Tolima, Colombia. These are the main areas for Anopheles mosquitoes, responsible for the transmission of malaria to man. Studies of *Aedes aegypti* have been conducted in the urban area of Cucuta.

The repellants used were: a) A soap based formulation (MRS) with a permethrin contents of 0.5% (Cis:trans ratio 25:75) and 20% deet, supplied by Simmons Nominees Pty. Ltd. Victoria, Australia, and b) A commercial stick repellant formulation (CR) easily obtainable in Colombia, Black Flag (R), of Home Products Inc.

Application:

For these tests the repellants were applied to both legs from the knees to the toes. Before application of MRS the surface of the skin was moistened with water (not drenched) MRS was rubbed after that. After rubbing a foamy film, similar to soap, formed. The foam was evenly distributed with the palm of the hand throughout the area to be protected for the tests. Once the MRS was evenly distributed it was allowed to dry (only a few seconds).

The CR was applied to the selected surfaces of another volunteer, following the manufacturer instructions printed in the label.

In each house selected for mosquito collection three people with collection experience were present, they were distributed as follows; one with MRS, another with CR and a third one without repellant and acting as controller. The three people were located in the vicinity of the house and the person without repellant was situated at less than 3 meters of the other volunteers with repellant. The time of collection was of 3 hours. In order to study the residual effect, i.e to obtain data after 7 hours from repellant application, the repellant was applied 4 hours before the mosquito collection. The repellant was applied only once for all tests.

All the mosquitoes that managed to bite or rest on the bait were captured. Collections were separated by subjects and hour. The anopheles were identified using the SEM key (Graphic key of some Anopheles females, common in Colombia, anagram SEM, 2pp, 1972) and the Gorham et. Al. (8,9).

For the analysis of data the Schreck formula was used (7) to calculate the repellence percentage as follows;

$$\frac{\text{Num. Over Control}-\text{Num. Over treated}}{\text{Num. Over control}} \times 100$$

RESULTS AND DISCUSSION

Table 1 shows the mosquito species collected during the test and the number collected in the Controls and with each repellant. The repellence percentages are also shown. Both repellants gave a high degree of protection varying between 88 and 99% with MRS and from 82 to 100% with CR. MRS did show a superior repellency for anopheles, then CR in some cases, except with An. Braziliensis. The lowest repellency effect for both formulations was with An. Nuñeztovari, with 87%

for MRS and 82% for CR. *Culex* sp. And *Aedes aegypti* both showed 98% and 99% reduction with MRS and CR respectively. Although some statistical differences were noted between MRS and CR ($p =$ or $- 0.05$) with *An. Darlingi*, all anopheles and *Culex* sp., these differences do not have practical importance.

Table 2 and Fig. 1 show the hourly residual effect for both formulations. For *An. Darlingi* and all anopheles, the repellent effect for MRS remained above 80% during 7 hours, while the effect of CR decreased to 77% after 5 hours and to less than 55% during 7 hours. With *Culex* sp. The MRS maintained a reduction above 80% for 5 hours and the CR for only 4 hours.

The results show that both repellants MRS and CR are equally effective for Anopheles, *Culex* and *Ae. Aegypti* up to 4 hours (reduction of more than 80%), however MRS has a greater residual effect until at least 7 and 5 hours for *Culex* sp. The MRS can have a residual effect superior to 7 hours but it was not tested in the experiments. The selection of one or other repellent is associated with the residual effect wanted and the cost of the product.

The two active ingredients used in the manufacture of MRS, deet and permethrin, have low toxicity for mammals, as indicated by Kenaga and Morgan in Yap, 1986 (6,10). It has been indicated that permethrin does not pose any danger to humans at the low dosages recommended for the various formulations (11).

14 people were involved with the tests and they were in direct contact with the repellants during 7 applications. None of the subjects showed any discomfort caused by the repellants. Yap reports similar results in Malaysia (6).

The success to control arthropod transmitted diseases is not satisfactory at present. For that reason it is important to include repellants as an additional weapon to complement the existing methods of prevention deserving evaluation within the context of epidemiology of the disease to control, therefore more investigation is required.

ACKNOWLEDGEMENTS

The authors wish to express their gratitude to Mr. Tom Simmons o Simmons Nominees Pty. Ltd, Victoria, Australia and to Mr. Rodrigo Salazar-Botero of Comercial Inter-Pacífico of Auckland, New Zealand for the supply of the soap type repellent. Also to doctors Rodolfo Gómez L., José S. Forero G. And Alejandro Rodríguez G. For their continuous support and to the officers of the Entomology Groups of the SEM zones of Villavicencio, Yopal, Cucuta, Girardot particularly to Libardo Cabrera, Jesús Torres, Uriel, Ibarra, Baudelino Díaz who made possible the collection of mosquitoes. To Mr. Alvaro López for his great help compiling the data.

RESUME

A biting reduction or repellence percentage was determined for the mosquitoes *Anopheles darlingi*, *An. Allopha*, *An. Braziliensis*, *An. nuñeztovari*, *An. lepidotus*, *Aedes aegypti* and *Culex* sp., after individual application of two repellants. One formulation of the soap type containing 20% deet and 0.5% permethrin, compared to a solid commercial repellent available in Colombia.

Both repellants showed a high degree of protection with ranges between 88 to 99% for the soap type repellent and 82 to 100% with the commercial repellent. There are statistical differences ($p =$ or $- 0.05$) between the two repellants for *An. darlingi* but these differences do not have practical importance. The results indicate that both repellants are equally effective for Anopheles, *Culex* and *Aedes aegypti* up to 4 hours with a reduction superior to 80%, but the soap type repellent has a

greater residual effect until at least 7 hours for anopheles. None of the 14 individuals subjected to the test showed any discomfort attributable to the repellants.

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TABLE 1
PERCENTAGE OF MOSQUITO BITE REDUCTION USING REPELLANTAS (1) (2)

GENUS/SPECIES	Nr. OF MOQUITOES BITING			% REPELLENCE	
	MRS	CR	CONTROL	MRS	CR
<i>An. darlingi</i>	6	30	817	99	96
<i>An. allopha</i>	7	10	276	97	96
<i>An. braziliensis</i>	7	0	104	93	100
<i>An. nuneztovari</i>	61	84	472	87	82
<i>An. lepidotus</i>	24		194	88	-
	130	210	2105	94	90
<i>Culex</i>	20	5	879	98	99
<i>Aedes aegypti</i>	3	2	180	98	99

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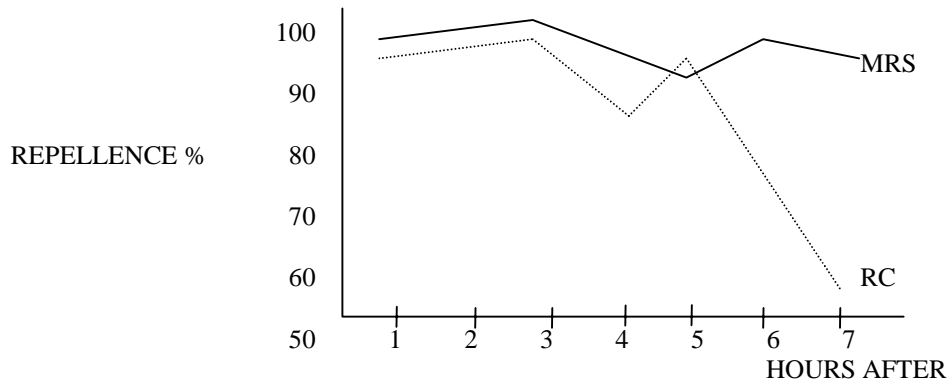
- (1) MRS: soap type repellent, deet 20%, permethrin 0.5%
 CR: COMERCIAL REPELLANT BLACK FLAG (R) HOME PRODUCTS.
- (2) UP TO 4 HOURS AFTER APPLICATION.
- (3) INCLUDING SOME SPECIES –NOT INDICATED ABOVE – (*An. evansae*, *An. fluminensis*, *An. oswaldoi*, *An. paoctinacula*, *An. rangel*, *An. strodei*), BUT EXCLUDING *An. lepidodus*.

TABLE 2

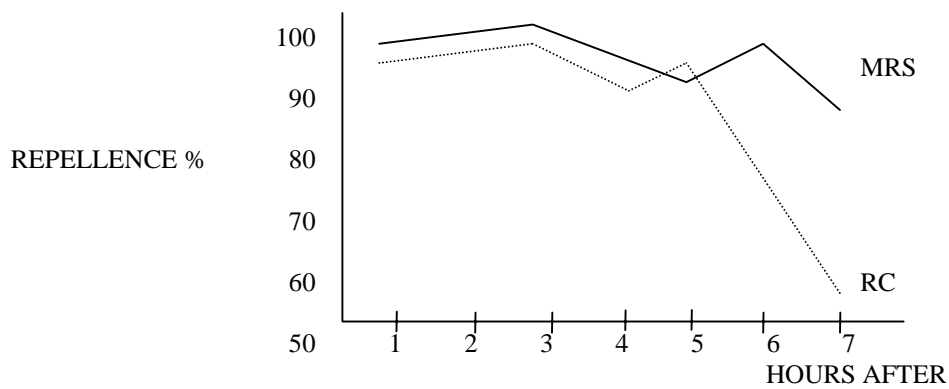
RESIDUAL EFFECT AFTER REPELLANT APPLICATION (1)

HOURS AFTER APPLICATION	An. darlingi			ALL ANOPHELES (2)			Culex		
	Nr.	REPELLENCE		Nr.	REPELLENCE		Nr.	REPELLENCE	
	BITING	PERCENTAGE		BITING	PERCENTAGE		BITING	PERCENTAGE	
	Control	MRS	CR	Control	MRS	CR	Control	MRS	CR
0-1	126	99	98	173	99	98	110	100	100
1-2	212	100	98	331	99	98	55	100	100
2-3	332	99	97	477	99	97	32	100	97
3-4	147	98	91	248	95	92	51	88	96
4-5	159	91	96	210	91	95	42	86	76
5-6	172	95	77	202	95	77	16	50	0
6-7	57	93	54	59	83	52	-	-	-

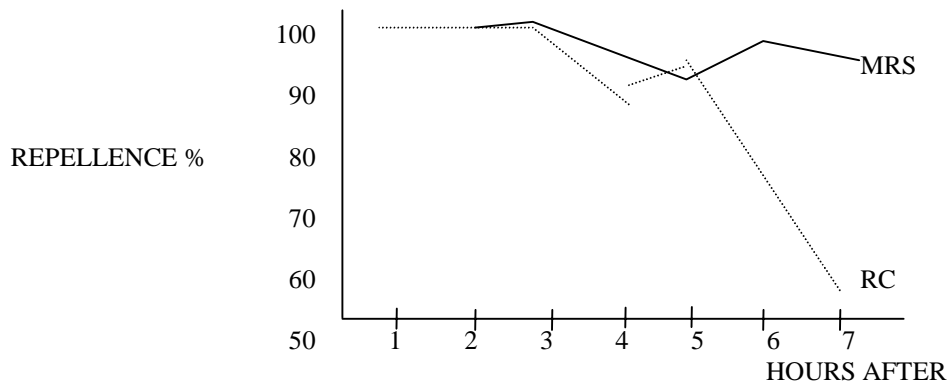
- (1) MRS: SOAP TYPE REPELLANT, DEET 20%, PERMETHRIN 0.5%.
 CR: COMMERCIAL REPELLANT, BLACK FLAG (R) HOME PRODUCTS.
- (2) *An. darlingi*, *An. allopha*, *An. braziliensis*,
An. mediopunctatus, *An. oswaldoi*, *An. pseudopunctipennis*,
An. triannulatus, *An. nuneztovari*, y *An. strodei*.



An. darlingi



ALL ANOPHELES



Culex

Fig. 1 . Residual effect in the reduction of the biting rate for three types of mosquitoes using a soap type repellent (MRS) and a commercial repellent (CR).

Rtj = Repellent Type Soap 20% Deet.

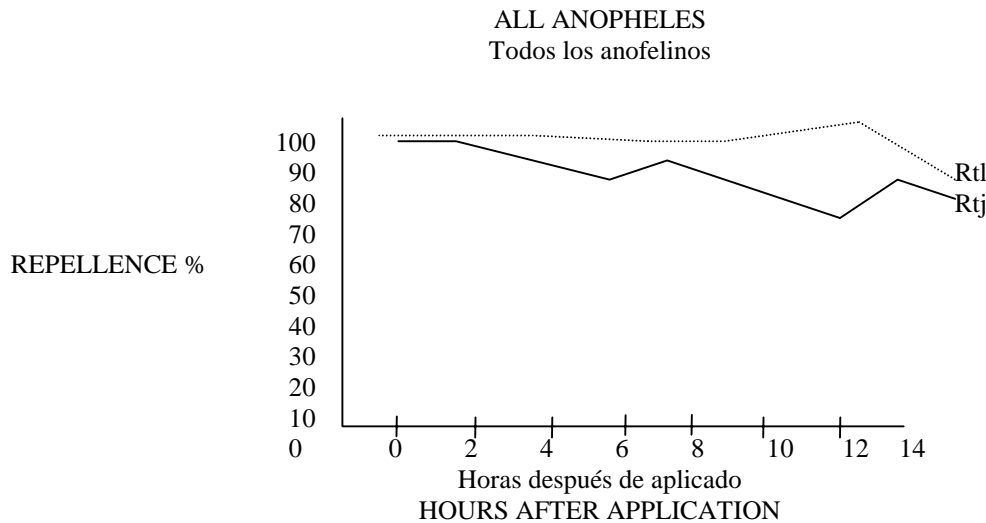
Rtl = Liquid type Repellent 95% Deet.

In this study were collected 1384 mosquitos on persons with RTJ, 270 mosquitos on persons with RTL, 9206 mosquitos on persons without repellent.

The following anophelenes species were collected. *An. albimanus*; *An. fluminensis*; *An punctimacula*; *An. darlingi*; *An. nuñeztovari*; *An. evansol*; *An. allopha*, etc.

The below curve represents the result of all the anophelenes combined.

The data of the previous paper has not been included as this is a different project.



RTJ = Repelente tipo jabón 20% Deet.

RTL = Repelente tipo liquido 95% Deet.

En este ensayo se colectaron:

1.384 mosquitos sobre personas con RTJ

270 mosquitos sobre personas con RTL

9.206 mosquitos sobre personas sin repelente.

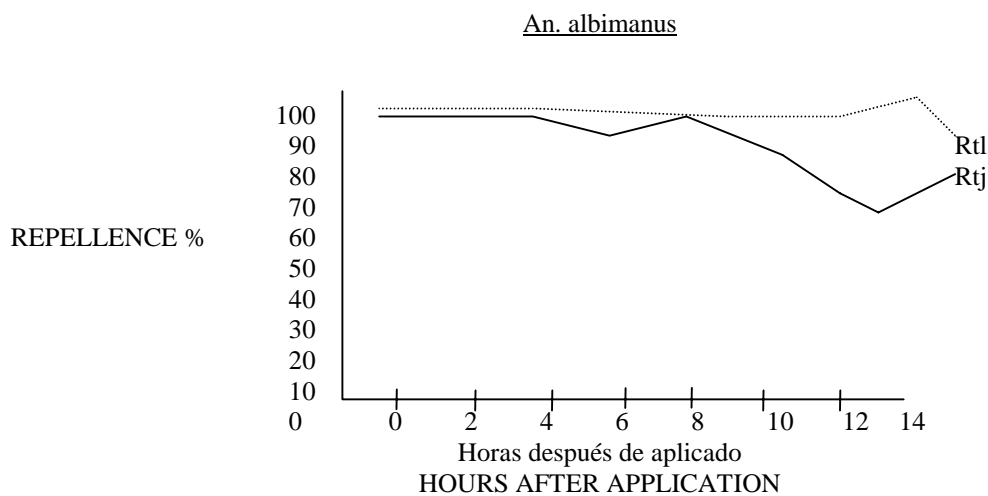
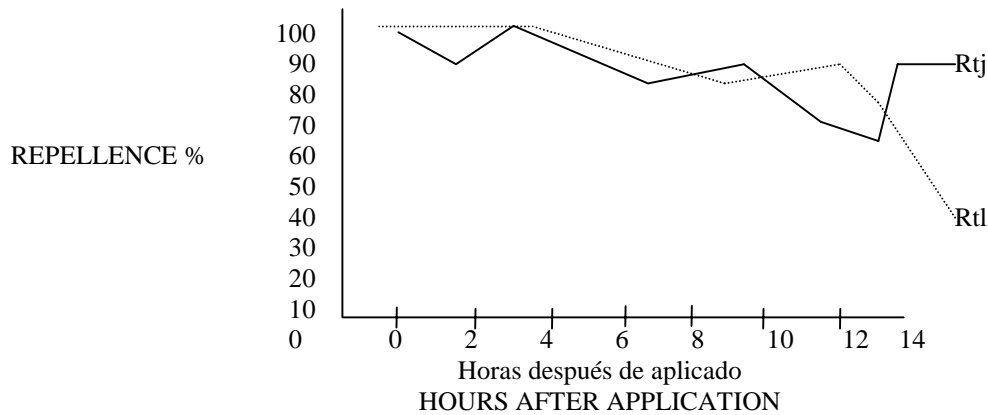
Se colectaron las siguientes especies de anofeles:

An. albimanos; *An. fluminensis*; *An punctimacula*; *An. darlingi*; *An. nuñeztovari*; *An evansol*; *An allopha*, etc. la curva representa los resultados de todos los anofelinos.

- No están incluidos los datos del informe anterior por ser un proyecto diferente.

Además le adjunto las curvas con *An. albimanos* y *An. darlingi* individualmente.

An. darlingi



RTJ = Repellent Type Soap 20% Deet.

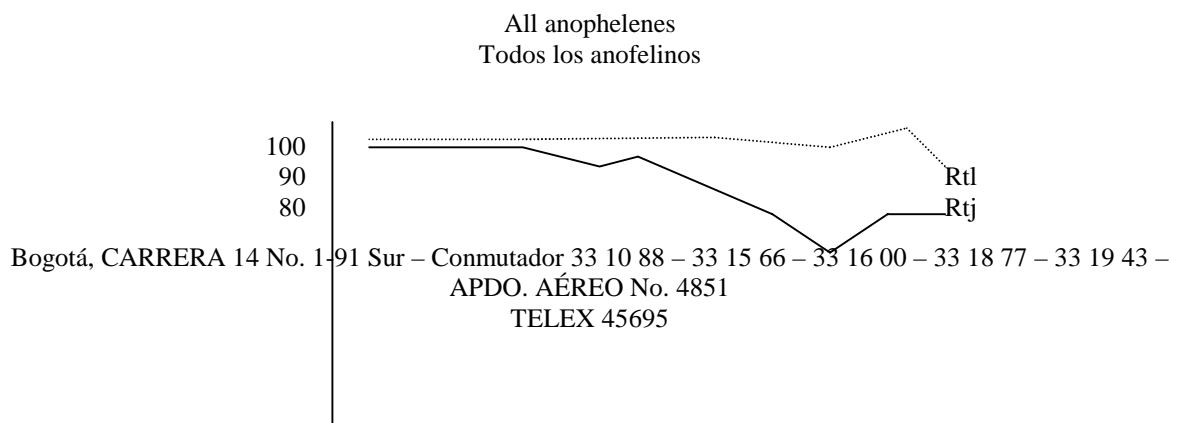
RTL = Liquid Type Repellent 95% Deet.

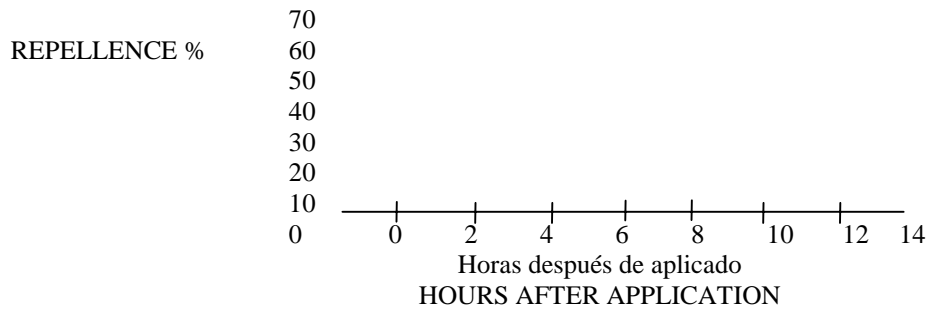
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The below curve represents the result of all the anophelenes combined.

The data of the previous paper has not been included as this is a different project.





Rtj = Repelente tipo jabón 20% Deet.

Rtl = Repelente tipo líquido 95%.

En este ensayo se colectaron:

1.384 mosquitos sobre personas con Rtj.

270 mosquitos sobre personas con Rtl.

9.206 mosquitos sobre personas sin repelente.

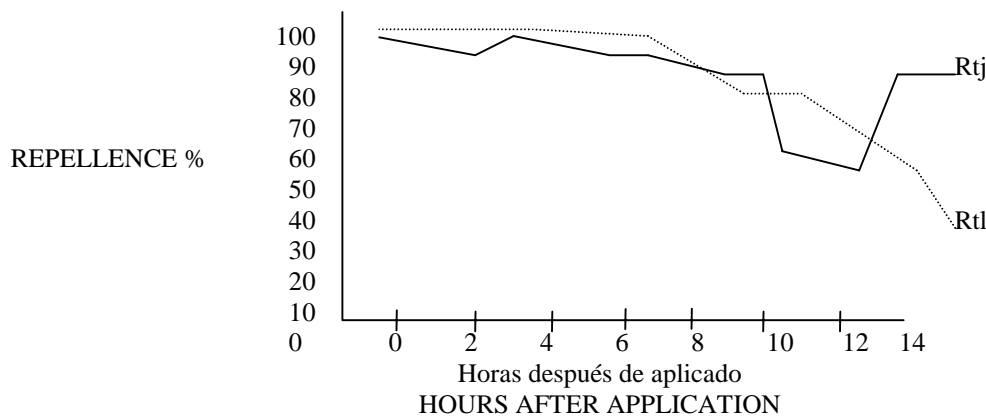
Se colectaron las siguientes especies de anofeles:

An. albimanus; An. fluminensis; An. punctimacula; An. darlingi; An. nuñeztovari; An. evansol; An. allopha etc.
la curva representa los resultados de todos los anofelinos.

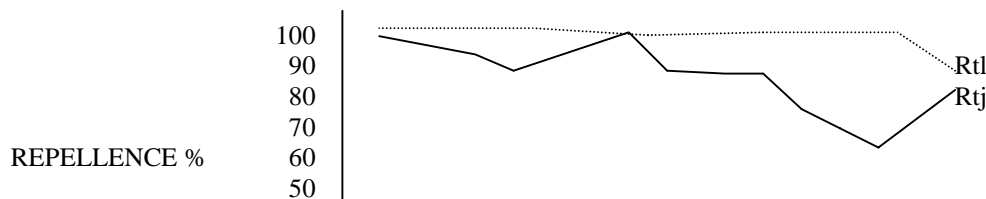
- No están incluidos los datos del informe anterior por ser un proyecto diferente.

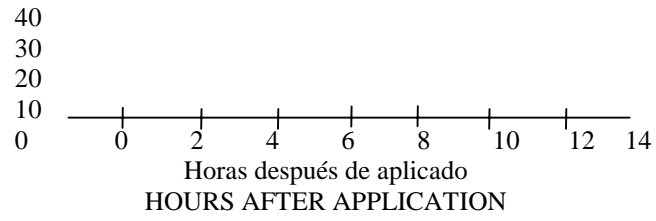
Además le adjunto las curvas con An. albimanus y An. darlingi individualmente.

An. darlingi



An. albimanus





REPÚBLICA DE COLOMBIA
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Dependencia: Entomología
Referencia

Número: 004115

31 jul 1986
Bogotá, Julio 24 de 1986

Sr. Rodrigo Salazar
Comercial Inter-Pacífico INC
P.O. Box 25-159, St. Heliers
Auckland 5,
New Zealand

Estimado Sr. Salazar:

Adjunto me permito anexar copia del informe presentado a esta Dirección, acerca de la evaluación de repelentes.

Sea esta la oportunidad para agradecer su gentileza en las gestiones que hicieron posible el suministro del producto por parte del Sr. T. Simons.

Cordialmente,

RODOLFO GÓMEZ LEÓN
Director
Campañas Directas

REPUBLIC OF COLOMBIA
MINISTRY OF HEALTH
NATIONAL SERVICE OF ERRADICATION OF MALARIA
S E M

Bogotá, 24 July 1986

Mr. Rodrigo Salazar-Botero
Comercial Inter-Pacifico INC
P.O. Box 25-159, St Heliers
Auckland 5,
NEW ZEALAND

Dear Mr. Salazar-Botero
Enclosed please find a copy of the study presented to this administration, concerning the evaluation of various repellents.

I would like to take this opportunity to thank you for your kind efforts which made it possible for us to have Mr. Tom Simmon's product.

Cordially yours,

(signed) RODOLFO GÓMEZ LEÓN
Director
NATIONAL SERVICE OF MALARIA ERRADICATION