



DEPARTMENT OF DEFENSE  
ARMED FORCES PEST MANAGEMENT BOARD  
FOREST GLEN SECTION, WRAMC  
WASHINGTON, D.C. 20307-5001

Mr. William Schawbel  
Chief Executive Officer, Schawbel Corp.  
Schraft Center  
529 Main St.  
Boston, MA 02129

6 January 2000

Dear Mr. Schawbel:

You will find enclosed the corrected Executive Summary for the field testing of the Area Repellent System (Thermacell Mosquito Repellent) that was done in Costa Rica against phlebotomine sand flies, mosquitoes and culicoides found outside in a coffee farm field. This is the final report as called for in the CRDA between Schawbel Corp. And WRAIR. Tests were done 30 November- 3 December 1999. The test data indicates that the Thermacell Mosquito Repellent, area repellent system to be very effective in protecting persons up to 25 feet away from the unit from attack by phlebotomine sand flies, mosquitoes and culicoides outside in Costa Rica.

I wish to thank you for the opportunity to test the Thermacell Mosquito Repellent as part of the CRDA between our two organizations. This agreement is mutually beneficial and I look forward to working with you and the Schawbel Corp. in the future.

Sincerely;

A handwritten signature in cursive script that reads "Michael J. Perich".

Michael J. Perich, Ph.D., B.C.E.  
Vector Suppression Program Manager  
Walter Reed Army Institute of Research

Enclosures:

## EXECUTIVE PROJECT SUMMARY

### EVALUATION OF AN AREA REPELLENT SYSTEM (Thermacell) AGAINST PHLEBOTOMINE SAND FLIES, MOSQUITOES AND CULICOIDES IN COSTA RICA FOR CRDA REPORT TO SCHAWBEL CORPORATION

PREPARED BY:  
MICHAEL J. PERICH, Ph.D., B.C.E.

In accordance with the conditions of the Cooperative Research and Development Agreement (CRDA) between Schawbel Corp. and Walter Reed Army Institute of Research, you will find the following report on the results from the study "Evaluation of an Area Repellent System (Thermacell) Against Phlebotomine Sand Flies, Mosquitoes and Culicoides in Costa Rica".

The study was conducted on a coffee farm in the locality of Brenon, latitude 9° 44' N, longitude 84° 11 W at an altitude of 741 meters, near San Jose, Costa Rica. This area has had a historical problem with cutaneous leishmaniasis and large populations of phlebotomine sand flies, the vector(s) of the cutaneous leishmaniasis. In addition, people living in this area have been bothered by annoying attacks by mosquito and culicoides (biting midges).

The test involved three replicates of treatment and one untreated control with each replicate group 20 meters apart. Tests were done for 4 nights, 30 November, 1, 2 and 3 December. Treatment consisted of placing an area repellent system at the end of row of small coffee trees (approximately 1 meter high) and then placing human bait collectors at 7.5, 15 and 25 feet away from the repellent unit. In similar design, a Thermacell unit with a untreated pad was set at the untreated control row. Units were turned on 15 minutes prior to first sampling time. Efficacy was determined by human landing collections which consisted of the the three persons at the above described distance from the units aspirating from the legs (ankle to knee) all mosquitoes landing on them. Collections were made for 15 minutes every hour from 1800 to 2300, the major host-seeking activity period for the phlebotomine sand flies, mosquitoes and culicoides in the Brenon area of Costa Rica. All sand flies, mosquitoes and culicoides collected were placed into labeled cartoons and later killed and returned to the lab to be identified to species and numerated.

Results from the field tests showed significant protection provided by the area repellent system (Thermacell) from phlebotomine sand fly, mosquito and culicoide attack (Tables). In the total 4 nights that tests were done: at the 7.5' 14 sand flies, 8 mosquitoes and 6 culicoides; at 15' 12 sand flies, 9 mosquitoes

and 5 culicoides; and at 25' 16 sand flies, 13 mosquitoes and 12 culicoides were collected from the untreated control row. Only 1 sand flies, 2 mosquito and 1 culicoides were collected at all the distances at all 3 rows which had the area repellent system. Thus, the area repellent system gave 95.5% protection from sand fly attack, 96.76% protection from mosquito attack, and 95.8% from culicoide attack in the Brenon area of Costa Rica.

Based on these results the area repellent system (Thermacell) when used in the described application, provided significant protection from phlebotomine sand flies, mosquitoes and culicoides in Costa Rica.

Table 1. The number of phlebotomine sand flies (SF), mosquitoes (M) and sand flies (C) collected from human landing collections in area repellent tests in Brenon, Costa Rica, 30 November 1999.

Treatment	Distance	Time														
		0 Hr			1 Hr			2 Hr			3 Hr			4 Hr		
		SF	M	C	SF	M	C	SF	M	C	SF	M	C	SF	M	C
Trt 1	7.5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trt 2	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trt 3	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Control	7.5	1	0	0	0	1	0	2	0	1	0	1	1	1	0	0
	15	0	0	0	1	1	0	1	0	1	0	0	0	0	1	1
	25	2	1	2	0	1	0	1	0	1	0	1	2	0	0	1

Table 2. The number of phlebotomine sand flies (SF), mosquitoes (M) and sand flies (C) collected from human landing collections in area repellent tests in Brenon, Costa Rica, 1 December 1999.

Treatment	Distance	Time														
		0 Hr			1 Hr			2 Hr			3 Hr			4 Hr		
		SF	M	C	SF	M	C	SF	M	C	SF	M	C	SF	M	C
Trt 1	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trt 2	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Trt 3	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Control	7.5	1	0	0	1	1	0	0	0	0	0	0	1	1	0	1
	15	1	1	0	1	0	1	0	0	0	0	0	0	1	1	0
	25	2	1	1	1	1	0	1	0	0	1	0	0	0	1	0

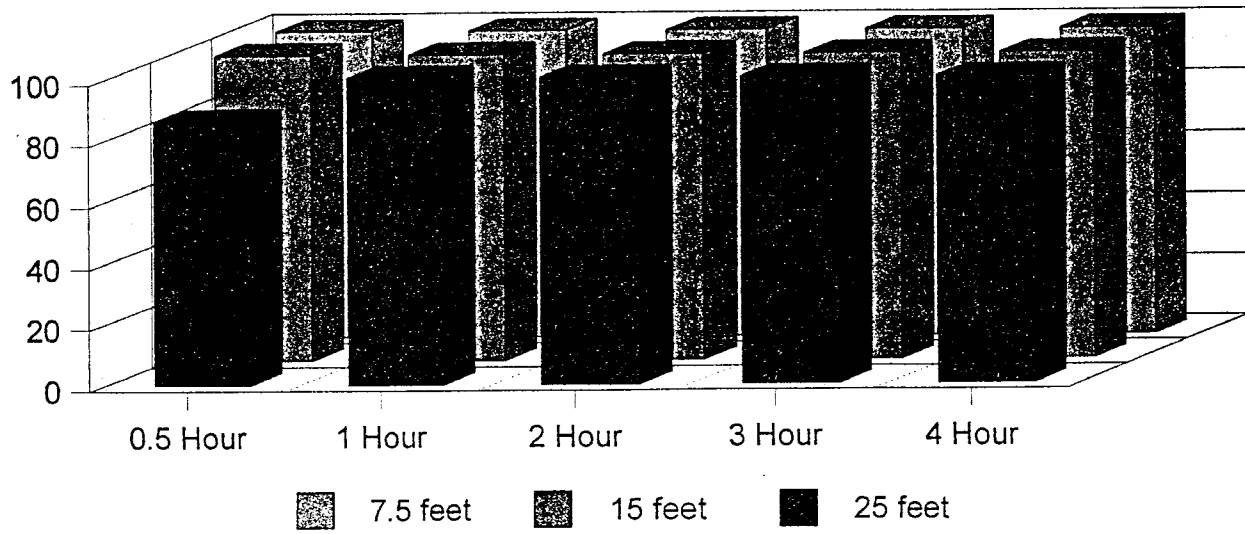
Table 3. The number of phlebotomine sand flies (SF), mosquitoes (M) and sand flies (C) collected from human landing collections in area repellent tests in Brenon, Costa Rica, 2 December 1999.

Treatment	Distance	Time															
		0 Hr			1 Hr			2 Hr			3 Hr			4 Hr			
		SF	M	C	SF	M	C	SF	M	C	SF	M	C	SF	M	C	
Trt 1	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Trt 2	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Trt 3	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	25	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Control	7.5	2	0	0	1	1	0	0	0	1	0	0	0	0	1	1	0
	15	1	0	0	2	0	1	0	1	0	0	1	0	0	1	0	0
	25	1	1	2	2	0	1	1	0	0	0	1	0	0	0	1	0

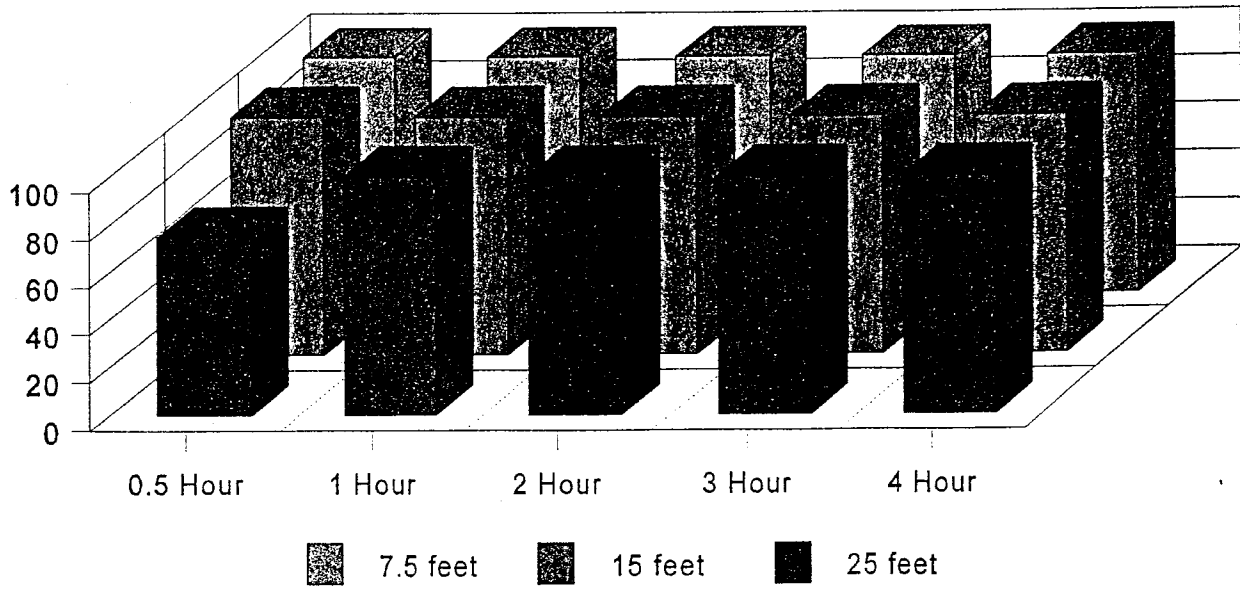
Table 4. The number of phlebotomine sand flies (SF), mosquitoes (M) and culicoides (C) collected from human landing collections in area repellent tests in Brenon, Costa Rica, 3 December 1999.

Treatment	Distance	Time														
		0 Hr			1 Hr			2 Hr			3 Hr			4 Hr		
		SF	M	C	SF	M	C	SF	M	C	SF	M	C	SF	M	C
Trt 1	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trt 2	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trt 3	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Control	7.5	1	0	1	1	0	0	0	2	0	0	0	1	0	1	0
	15	1	0	1	0	0	1	1	1	0	0	1	0	0	1	0
	25	1	0	2	1	0	2	1	1	1	0	0	0	0	1	0

# Efficacy of TheraCell Against Sand Flies



# Efficacy of Thermacell Against Mosquitoes



# Efficacy of TheraCell Against Culicoides

